

Remarks

A. Pending Claims

Claims 466-469, 471-492, 494-507, and 509-518 are currently pending. Claims 466, 473, 485, 487, 497, 504, and 510 have been amended. Claims 470, 493, and 508 have been cancelled.

B. Election of Species

The Office Action states: “Regarding Species A(1), the traversal is on the ground that species (2)-(4) are subsets of species (1). Remarks, at 2. However, species (1) consists of embodiments with heaters and methods of heating comprising a single ferromagnetic material only (i.e., without any additional material (ferromagnetic or non-ferromagnetic).” Applicant submits that the claims use the terms “comprises” or “comprising” in reference to inclusion of the ferromagnetic material in the features of the claims. Applicant’s use of the terms “comprises” or “comprising” does not limit the claims to a single ferromagnetic material as per MPEP § 2111.03, which states:

The transitional term “comprising”, which is synonymous with “including,” “containing,” or “characterized by,” is inclusive or open-ended and does not exclude additional, unrecited elements or method steps.”

Therefore, species A(1) is not limited to only a single ferromagnetic material (i.e., without any additional material (ferromagnetic or nonferromagnetic)) as stated in the Office Action. Applicant respectfully requests removal of the election requirement.

C. The Claims Are Not Anticipated by EP130671 Pursuant To 35 U.S.C. §102(b)

Claims 466-469, 474, 475, 478-480, 483-486, 489-492, 495, 496, and 500-502 were rejected under 35 U.S.C. §102(b) as being anticipated by European Patent Application 0130671 to Rose (hereinafter “EP130671”). Applicant respectfully disagrees with these rejections.

The standard for “anticipation” is one of fairly strict identity. To anticipate a claim of a patent, a single prior source must contain all the claimed essential elements. *Hybritech, Inc. v. Monoclonal Antibodies, Inc.*, 802 F.2d 1367, 231 U.S.P.Q.81, 91 (Fed.Cir. 1986); *In re Donahue*, 766 F.2d 531, 226 U.S.P.Q. 619, 621 (Fed.Cir. 1985).

Amended claim 466 describes a combination of features including: “wherein the heater system is configured to provide heat to a subsurface formation.” Claim 466 was amended to include the features of claim 470. Amended claim 485 describes a combination of features including: “allowing heat to transfer from at least one of the electrically resistive sections to at least a part of a subsurface formation.” Claim 485 was amended to include the features of claim 493. Amended claim 504 describes a combination of features including: “wherein the heater system is configured to provide heat to a subsurface formation.” Claim 504 was amended to include the features of claim 508.

EP130671 does not appear to teach or suggest at least the above-quoted features of the claims in combination with the other features of the claims. Applicant respectfully requests removal of the anticipation rejection of claims 466, 485, 504, and the claims dependent thereon.

In addition, many of the claims dependent on claims 466, 485, and 504 are believed to be separately patentable. Claim 467 describes a combination of features including: “wherein the AC supply is coupled to a supply of line current, and wherein the AC supply is configured to provide AC at about three times the frequency of the line current.” The cited art does not appear to teach or suggest at least the above-quoted features of claim 467, in combination with the other features of the claim.

Claim 468 describes a combination of features including: “wherein the AC supply is configured to provide AC with a frequency between about 140 Hz and about 200 Hz.” The cited art does not appear to teach or suggest at least the above-quoted features of claim 468, in combination with the other features of the claim.

Claim 469 describes a combination of features including: “wherein AC supply is configured to provide AC with a frequency between about 400 Hz and about 550 Hz.” The cited art does not appear to teach or suggest at least the above-quoted features of claim 469, in combination with the other features of the claim.

Claim 474 describes a combination of features including: “wherein the ferromagnetic material comprises iron, nickel, chromium, cobalt, tungsten, or a mixture thereof.” The cited art does not appear to teach or suggest at least the above-quoted features of claim 474, in combination with the other features of the claim.

Claim 475 describes a combination of features including: “wherein a thickness of the ferromagnetic material is at least about $\frac{3}{4}$ of a skin depth of the AC at the Curie temperature of the ferromagnetic material.” The cited art does not appear to teach or suggest at least the above-quoted features of claim 475, in combination with the other features of the claim.

Claim 478 describes a combination of features including: “wherein at least a portion of at least one of the electrical conductors is longer than about 10 m.” The cited art does not appear to teach or suggest at least the above-quoted features of claim 478, in combination with the other features of the claim.

Claim 479 describes a combination of features including: “wherein the heater system is configured to sharply reduce the heat output at or near the selected temperature.” The cited art does not appear to teach or suggest at least the above-quoted features of claim 479, in combination with the other features of the claim.

Claim 480 describes a combination of features including: “wherein the heater system is configured such that the heat output of at least a portion of the system decreases at or near the selected temperature due to the Curie effect.” The cited art does not appear to teach or suggest at least the above-quoted features of claim 480, in combination with the other features of the claim.

Claim 483 describes a combination of features including: “wherein the heater system is configured to withstand operating temperatures of about 250 °C or above.” The cited art does not appear to teach or suggest at least the above-quoted features of claim 483, in combination with the other features of the claim.

Claim 484 describes a combination of features including: “wherein the electrical conductor is configured to automatically provide the reduced amount of heat above or near the selected temperature.” The cited art does not appear to teach or suggest at least the above-quoted features of claim 484, in combination with the other features of the claim.

Claim 486 describes a combination of features including: “providing the AC to the electrical conductor when the electrical conductor is at or above the selected temperature.” The cited art does not appear to teach or suggest at least the above-quoted features of claim 486, in combination with the other features of the claim.

Claim 489 describes a combination of features including: “providing the AC at about three times the frequency of line current from an AC supply.” The cited art does not appear to teach or suggest at least the above-quoted features of claim 489, in combination with the other features of the claim.

Claim 490 describes a combination of features including: “providing the AC at a frequency between about 140 Hz and about 200 Hz.” The cited art does not appear to teach or suggest at least the above-quoted features of claim 490, in combination with the other features of the claim.

Claim 491 describes a combination of features including: “providing the AC at a frequency between about 400 Hz and about 550 Hz.” The cited art does not appear to teach or suggest at least the above-quoted features of claim 491, in combination with the other features of the claim.

Claim 492 describes a combination of features including: “providing the AC to the electrical conductor when the electrical conductor is at or above the selected temperature.” The cited art does not appear to teach or suggest at least the above-quoted features of claim 492, in combination with the other features of the claim.

Claim 495 describes a combination of features including: “wherein an AC resistance of the electrical conductor decreases above the selected temperature to provide the reduced amount of heat.” The cited art does not appear to teach or suggest at least the above-quoted features of claim 495, in combination with the other features of the claim.

Claim 496 describes a combination of features including: “wherein a thickness of the ferromagnetic material is at least about $\frac{3}{4}$ of a skin depth of the AC at the Curie temperature of the ferromagnetic material.” The cited art does not appear to teach or suggest at least the above-quoted features of claim 496, in combination with the other features of the claim.

Claim 500 describes a combination of features including: “controlling a skin depth in the electrical conductor by controlling a frequency of the AC applied to the electrical conductor.” The cited art does not appear to teach or suggest at least the above-quoted features of claim 500, in combination with the other features of the claim.

Claim 501 describes a combination of features including: “controlling the heat applied from the electrical conductor by allowing less heat to be applied from any part of the electrical conductor that is at or near the selected temperature.” The cited art does not appear to teach or suggest at least the above-quoted features of claim 501, in combination with the other features of the claim.

Claim 502 describes a combination of features including: “controlling the amount of current applied to the electrical conductor to control an amount of heat provided by at least one of the electrically resistive sections.” The cited art does not appear to teach or suggest at least the above-quoted features of claim 502, in combination with the other features of the claim.

D. **The Claims Are Not Obvious Over EP130671 In View of Pritchett Pursuant To 35 U.S.C. §103(a)**

Claims 470, 473, 476, 477, 481, 482, 487, 488, 493, 494, 497, 499, 503-508, and 510-518 were rejected under 35 U.S.C. § 103(a) as being unpatentable over EP130671 in view of U.S. Patent No. 3,757,860 to Pritchett (hereinafter “Pritchett”). Applicant respectfully disagrees with these rejections.

To reject a claim as obvious, the Examiner has the burden of establishing a *prima facie* case of obviousness. *In re Warner et al.*, 379 F.2d 1011, 154 U.S.P.Q. 173, 177-178 (C.C.P.A. 1967). To establish *prima facie* obviousness of a claimed invention, all the claim limitations must be taught or suggested by the prior art. *In re Royka*, 490 F.2d 981, 180 U.S.P.Q. 580 (C.C.P.A. 1974), MPEP § 2143.03.

Obviousness can only be established by combining or modifying the teachings of the prior art to produce the claimed invention where there is some teaching, suggestion, or motivation to do so found either in the references themselves or in the knowledge generally available to one of ordinary skill in the art. *In re Fine*, 837 F.2d 1071, 5 USPQ2d 1596 (Fed. Cir. 1988); *In re Jones*, 958 F.2d 347, 21 USPQ2d 1941 (Fed. Cir. 1992), MPEP § 2143.01.

Claim 466 was amended to include the features of claim 470. Claim 485 was amended to include the features of claim 493. Claim 504 was amended to include the features of claim 508.

Amended claim 466 describes a combination of features including: “wherein the electrical conductor comprises an electrically resistive ferromagnetic material and is configured to provide a reduced amount of heat above or near a selected temperature”.

Amended claim 485 describes a combination of features including: “wherein at least one of the electrically resistive sections comprises an electrically resistive ferromagnetic material and

provides a reduced amount of heat above or near a selected temperature”.

Amended claim 504 describes a combination of features including: “wherein the electrical conductor comprises an electrically resistive ferromagnetic material and is configured to provide a reduced amount of heat above or near a selected temperature that is about 20% or less of the heat output at about 50 °C below the selected temperature”.

The cited art does not appear to teach or suggest systems or methods for heating a subsurface formation in which a reduced amount of heat is provided above or near a selected temperature as described in the above-quoted features of the claims.

EP 130671 states: “In operation, as the Curie temperature of the first layer is approached and its permeability rapidly decreases, the current spreads into the copper layer and into the second magnetic layer. The total resistance of the structure, due to the presence of the copper, drops dramatically providing a high autoregulating ratio.” (EP130671, page 8, lines 9-14). EP130671 appears to teach or suggest electrically coupling one or more other materials to the ferromagnetic material and allowing the current to conduct into the other materials as the Curie temperature of the ferromagnetic material is approached.

Pritchett states:

By employing the skin effect, as defined hereinafter, a loss of current and short-circuiting problems are minimized because by utilizing the skin effect the results of this invention are achieved even if another pipe is touching or otherwise electrically connected to the pipe which is carrying the alternating current according to this invention. Also, by employing the skin effect, where an inner pipe is touching the outer pipe or at other similar points of contact along the outer pipe severe local heating and even welding of the two pipes together is avoided. The avoidance of local heating at any such point of contact is important to avoid damage to the pipes or permafrost or both.

(Pritchett, column 3, lines 19-31)

Pritchett appears to teach or suggest limiting current to skin depth of the ferromagnetic material so that little or no current leaks to any other electrically conducting materials in contact

with the ferromagnetic material. Modifying EP130671 in view of Pritchett would appear to teach away from the intended purpose of the invention of EP130671 of allowing the current to conduct into the other materials as the Curie temperature of the ferromagnetic material is approached.

If proposed modification would render the prior art invention being modified unsatisfactory for its intended purpose, then there is no suggestion or motivation to make the proposed modification. *In re Gordon*, 733 F.2d 900, 221 USPQ 1125 (Fed. Cir. 1984).

In addition, EP130671 states: “Below the Curie temperature, the majority of the current flows in the magnetic layer when the thickness of this layer is nominally one skin depth of the material below the Curie temperature. In the region of the Curie temperature, the majority of the current now flows in the copper and the resistance drops dramatically.” (EP130671, page 3, lines 1-6). EP130671 appears to teach or suggest allowing current to flow into copper to allow the resistance of the heater to drop.

Pritchett states: “According to this invention, an alternating electrical current is applied directly to a pipe which extends longitudinally into the wellbore, preferably to the outermost pipe in the well.” (Pritchett, column 2, lines 37-40). Pritchett also states:

Another important reason for the use of alternating current is that with the alternation of the current through the electrical circuit there comes an inductance effect which causes the current, for example, passing through casing 4, to tend to flow along the surface of the casing rather than through the interior of the casing. This inductance effect is often termed a “skin effect.” An additional result that accompanies the skin effect is that the effective electrical impedance of the casing to the alternating current being applied thereto increases above the normal impedance value of that pipe.

(Pritchett, column 5, line 63 to column 6, line 6)

Pritchett appears to teach or suggest limiting the alternating current to the skin of the heater during use of the heater to achieve the effects described above. EP130671 does not appear to teach, suggest, or provide motivation for limiting the alternating current to the skin depth of the heater during use of the heater as described in Pritchett. Modifying EP130671 in view of

Pritchett would appear to teach away from the intended purpose of the invention of EP130671 of allowing current to flow into copper to allow the resistance of the heater to drop.

The cited art does not appear to teach, suggest, or provide motivation for systems or methods for heating a subsurface formation in which a reduced amount of heat is provided above or near a selected temperature as described in the claims. Applicant respectfully requests removal of the rejection of claims 466, 485, 504, and the claims dependent thereon.

In addition, many of the claims dependent on claims 466, 485, and 504 are believed to be separately patentable. Claim 473 describes a combination of features including: “wherein the heater system is configured to provide heat to at least a portion of an opening in the subsurface formation.” The cited art does not appear to teach or suggest at least the above-quoted features of claim 473, in combination with the other features of the claim.

Claim 476 describes a combination of features including: “wherein the heat output below the selected temperature is greater than about 400 watts per meter of the electrical conductor.” The cited art does not appear to teach or suggest at least the above-quoted features of claim 476, in combination with the other features of the claim.

Claim 477 describes a combination of features including: “wherein at least a portion of at least one of the electrical conductors is configured to comprise a relatively flat AC resistance profile in a temperature range between about 100 °C and 750 °C.” The cited art does not appear to teach or suggest at least the above-quoted features of claim 477, in combination with the other features of the claim.

Claim 481 describes a combination of features including: “wherein the system is configured to apply AC of at least about 70 amps to at least one of the electrically resistive sections.” The cited art does not appear to teach or suggest at least the above-quoted features of claim 481, in combination with the other features of the claim.

Claim 482 describes a combination of features including: “wherein at least one of the electrically resistive sections comprises a turndown ratio of at least about 2 to 1.” The cited art does not appear to teach or suggest at least the above-quoted features of claim 482, in combination with the other features of the claim.

Claim 487 describes a combination of features including: “placing the electrical conductor in a wellbore in the subsurface formation.” The cited art does not appear to teach or suggest at least the above-quoted features of claim 487, in combination with the other features of the claim.

Claim 488 describes a combination of features including: “providing an initial electrically resistive heat output when the electrical conductor providing the heat output is at least about 50 °C below the selected temperature, and automatically providing the reduced amount of heat above or near the selected temperature.” The cited art does not appear to teach or suggest at least the above-quoted features of claim 488, in combination with the other features of the claim.

Claim 494 describes a combination of features including: “providing a relatively constant heat output when the ferromagnetic material is in a temperature range between about 100 °C and 750 °C.” The cited art does not appear to teach or suggest at least the above-quoted features of claim 494, in combination with the other features of the claim.

Claim 497 describes a combination of features including: “allowing heat to transfer from the electrical conductor to at least a part of the subsurface formation, wherein the subsurface formation comprises a hydrocarbon containing formation.” The cited art does not appear to teach or suggest at least the above-quoted features of claim 497, in combination with the other features of the claim.

Claim 499 describes a combination of features including: “providing a reduced amount of heat above or near the selected temperature of less than about 400 watts per meter of length of

the electrical conductor.” The cited art does not appear to teach or suggest at least the above-quoted features of claim 499, in combination with the other features of the claim.

Claim 503 describes a combination of features including: “applying current of at least about 70 amps to the electrical conductor.” The cited art does not appear to teach or suggest at least the above-quoted features of claim 503, in combination with the other features of the claim.

Claim 505 describes a combination of features including: “wherein the AC supply is coupled to a supply of line current, and wherein the AC supply is configured to provide AC at about three times the frequency of the line current.” The cited art does not appear to teach or suggest at least the above-quoted features of claim 505, in combination with the other features of the claim.

Claim 506 describes a combination of features including: “wherein the frequency is between about 140 Hz and about 200 Hz.” The cited art does not appear to teach or suggest at least the above-quoted features of claim 506, in combination with the other features of the claim.

Claim 507 describes a combination of features including: “wherein the frequency is between about 400 Hz and about 550 Hz.” The cited art does not appear to teach or suggest at least the above-quoted features of claim 507, in combination with the other features of the claim.

Claim 510 describes a combination of features including: “wherein the heater system is configured to provide heat to at least a portion of an opening in the subsurface formation.” The cited art does not appear to teach or suggest at least the above-quoted features of claim 510, in combination with the other features of the claim.

Claim 511 describes a combination of features including: “wherein the ferromagnetic material comprises iron, nickel, chromium, cobalt, tungsten, or a mixture thereof.” The cited art does not appear to teach or suggest at least the above-quoted features of claim 511, in combination with the other features of the claim.

Claim 512 describes a combination of features including: “wherein a thickness of the ferromagnetic material is at least about $\frac{3}{4}$ of a skin depth of the AC at the Curie temperature of the ferromagnetic material.” The cited art does not appear to teach or suggest at least the above-quoted features of claim 512, in combination with the other features of the claim.

Claim 513 describes a combination of features including: “wherein the heat output below the selected temperature is greater than about 400 watts per meter of length of the electrical conductor.” The cited art does not appear to teach or suggest at least the above-quoted features of claim 513, in combination with the other features of the claim.

Claim 514 describes a combination of features including: “wherein at least a portion of at least one of the electrical conductors is configured to comprise a relatively flat AC resistance profile in a temperature range between about 100 °C and 750 °C.” The cited art does not appear to teach or suggest at least the above-quoted features of claim 514, in combination with the other features of the claim.

Claim 515 describes a combination of features including: “wherein the heater system is configured to sharply reduce the heat output at or near the selected temperature.” The cited art does not appear to teach or suggest at least the above-quoted features of claim 515, in combination with the other features of the claim.

Claim 516 describes a combination of features including: “wherein the system is configured to apply AC of at least about 70 amps to at least one of the electrically resistive sections.” The cited art does not appear to teach or suggest at least the above-quoted features of claim 516, in combination with the other features of the claim.

Claim 517 describes a combination of features including: “wherein at least one of the electrically resistive sections comprises a turndown ratio of at least about 2 to 1.” The cited art does not appear to teach or suggest at least the above-quoted features of claim 517, in

combination with the other features of the claim.

Claim 518 describes a combination of features including: “wherein the electrical conductor is configured to automatically provide the reduced amount of heat above or near the selected temperature.” The cited art does not appear to teach or suggest at least the above-quoted features of claim 518, in combination with the other features of the claim.

E. The Claims Are Not Obvious Over EP130671 In View of Vanegmond et al. Pursuant To 35 U.S.C. §103(a)

Claims 471 and 498 were rejected under 35 U.S.C. § 103(a) as being unpatentable over EP130671 in view of U.S. Patent No. 4,572,999 to Vanegmond et al. (hereinafter “Vanegmond”). Applicant respectfully disagrees with these rejections.

Claim 471 describes a combination of features including: “wherein the heater system is configured to provide heat to a hydrocarbon containing formation, and wherein the heater system is configured to pyrolyze at least some hydrocarbons in the formation.” The cited art does not appear to teach or suggest at least the above-quoted features of claim 471, in combination with the other features of the claim.

Claim 498 describes a combination of features including: “allowing heat to transfer from the electrical conductor to at least a part of a hydrocarbon containing formation, and pyrolyzing at least some hydrocarbons in the formation.” The cited art does not appear to teach or suggest at least the above-quoted features of claim 498, in combination with the other features of the claim.

F. The Claim Is Not Obvious Over EP130671 In View of Pritchett And Further In View of Vanegmond et al. Pursuant To 35 U.S.C. §103(a)

Claim 509 was rejected under 35 U.S.C. §103(a) as being unpatentable over EP130671 in view of Pritchett and further in view of Vanegmond. Applicant respectfully disagrees with these

rejections.

Claim 509 describes a combination of features including: “wherein the heater system is configured to provide heat to a hydrocarbon containing formation, and wherein the heater system is configured to pyrolyze at least some hydrocarbons in the formation.” The cited art does not appear to teach or suggest at least the above-quoted features of claim 509, in combination with the other features of the claim.

G. Double Patenting Rejection

Claims 466-471 and 473-518 were provisionally rejected under the judicially created doctrine of obviousness-type double patenting as being unpatentable over claims 268-408, 625, 659, 685, and 710 of copending U.S. Pat. Appl. No. 10/693,816 in view of EP130671. Upon the present application being in condition for allowance but for the double patenting rejections, Applicant will provide arguments for the inappropriateness of the double patenting rejections and/or provide a terminal disclaimer.

H. Other Pertinent Prior Art

Applicant has reviewed the other pertinent prior art identified by the Office Action. Applicant believes that for at least the reasons outlined above in sections C-F of this document that the cited art does not appear to teach or suggest the features of the claims.

I. Additional Comments

Applicant respectfully requests a two-month extension of time. If any additional extension of time is necessary, Applicant hereby requests the appropriate extension of time. A Fee Authorization is enclosed for the extension of time fee. If any additional fees are required, please appropriately charge those fees to Meyertons, Hood, Kivlin, Kowert & Goetzel, P.C. Deposit Account Number 50-1505/5659-21000/EBM.

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